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INVESTIGATION OF GROUND-WATER CONTAMINATION IN A SHALLOW AQUIFER AT BENTON, MISSISSIPPI

by

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The community of Benton is located in portions of ctions 1, 2, 11, and 12, T.11N., R.1W., in Yazoo ounty, Mississippi, approximately seven miles east of azoo City. Historically, the local water supply was om a shallow terrace deposit located from thirty to rty feet from the ground surface. Two well fields, cated approximately one-third of a mile apart, pro-de water for the local water system. They are known cally as the north and south well fields (Figure 1). ter some of the 3000 residential customers com-ained of taste and odor problems, the water supply ells were sampled by the Bureau of Pollution Control. he results of samples collected on February 8 and 15, 984, showed the presence of benzene, ethylbenzene, luene, acetone, 2-butanone, O-xylene, and isopropyl-her. A private supply well located approximately 00 feet south of the north well field also was found be contaminated.

Since the Benton water system was the only potable ater supply for the community, the Environmental otection Agency and its F.I.T. contractor, the N.U.S. Corporation, did an on-site investigation during the week of March 12-16, 1984. At this time 17 water samples, 12 soil samples, and 10 sediment samples were collected. However, the data derived from the N.U.S. study did not appear to be extensive and conclusive enough to determine which area is responsible for contaminating the Benton water system.

Because Benton has connected to the Central Yazoo Water Association, the E.P.A. can no longer be involved with this problem. However, the study does conclude that "contamination of the third supply well of the north well field has been confirmed, and it is apparent that each of the other supply wells of the Benton Mississippi Water Supply System are contaminated to some extent. It is believed that the data is insufficient to determine a source or sources of contamination of the area. Further investigation through monitoring well installation and sample collection would be necessary to complete the objectives of this study."

In July 1985 the Bureau of Geology began an investigation into geohydrologic conditions of the

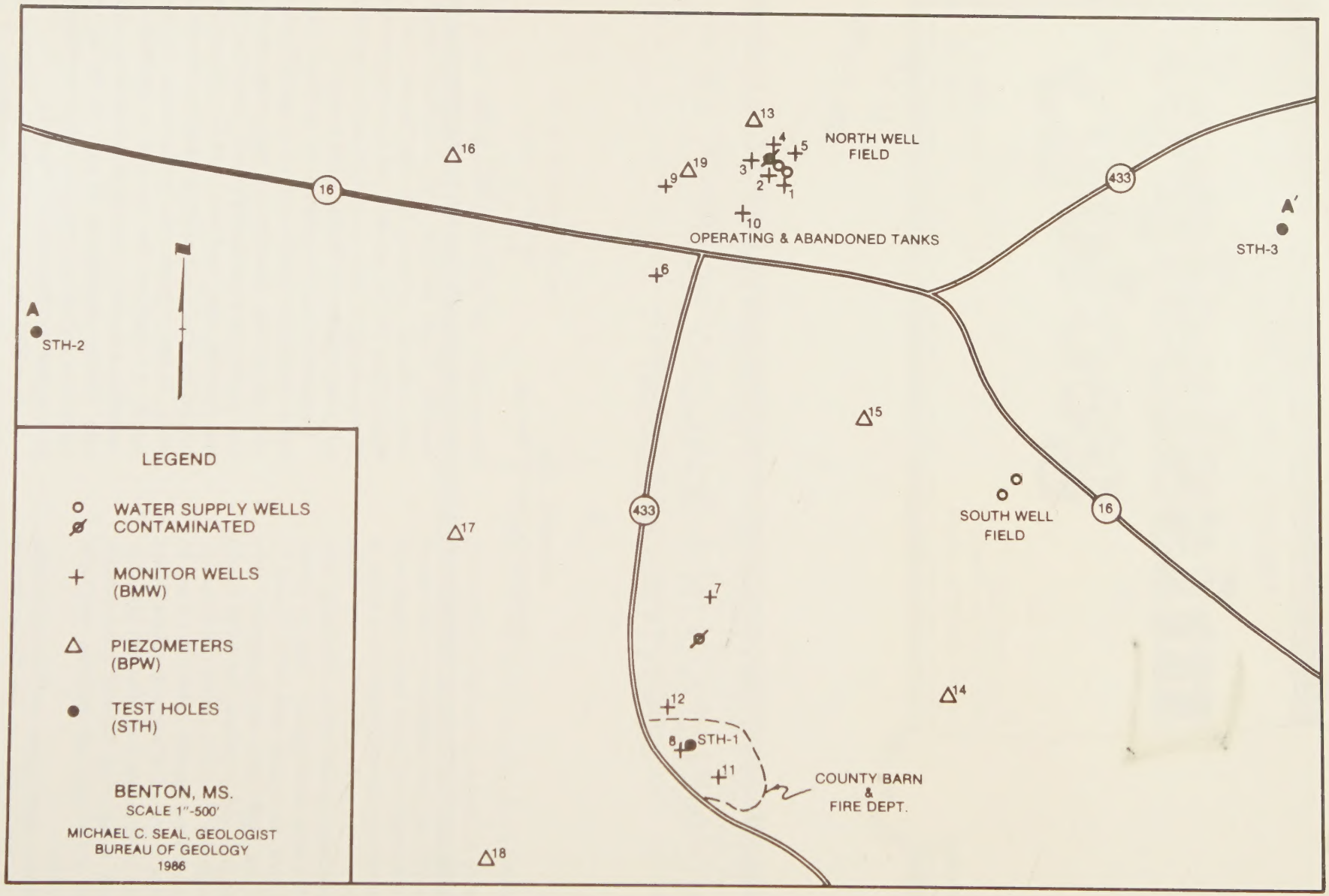
NORTH WELL FIELD
OPERATING & ABANDONED TANKS
SOUTH WELL FIELD
COUNTY BARN & FIRE DEPT.
STH-1
STH-2
STH-3
A
A'
16
433
LEGEND
WATER SUPPLY WELLS
CONTAMINATED
MONITOR WELLS (BMW)
PIEZOMETERS (BPW)
TEST HOLES (STH)
BENTON, MS.
SCALE 1"-500'
MICHAEL C. SEAL, GEOLOGIST
BUREAU OF GEOLOGY
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Figure 1.

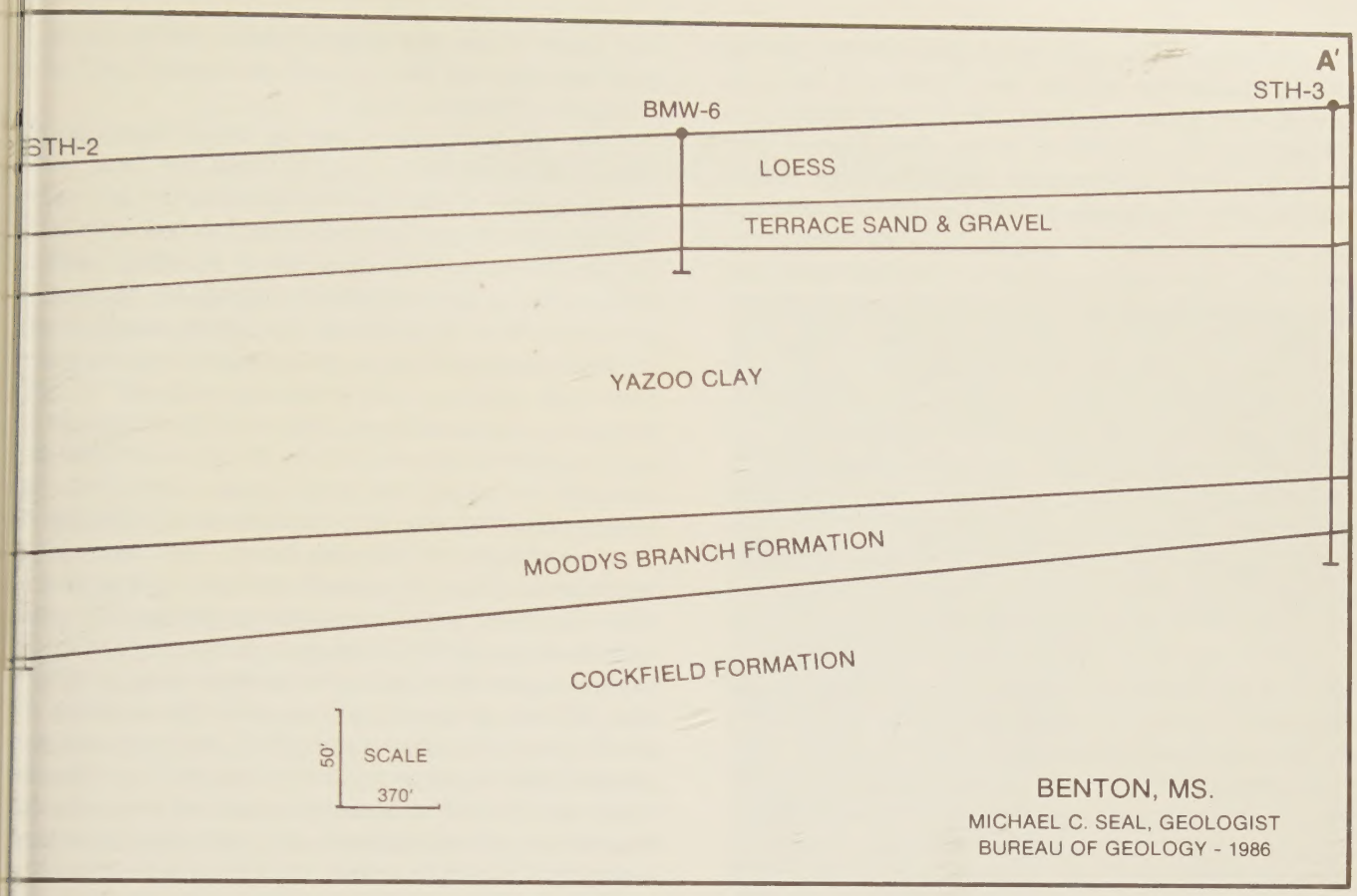


Figure 2.

Benton ground-water supply. This investigation was result of a request for assistance from the Bureau of Pollution Control concerning known contamination of the Benton water supply by petroleum products. The suspected cause of the contamination is unintentional release from underground storage tanks.

After discussions with Bureau of Pollution Control officials, the owner of the local water distribution system, and local residents, and a review of existing information concerning this problem, a plan was formulated to study and perhaps resolve this situation.

Initial field work consisted of a tour of the Benton community to locate all known underground storage tanks and the location of possible abandoned tanks. The largest concentration of both categories is along Highway 16, which is located a few hundred feet south of the contaminated well field. These locations consist of gasoline stations that are currently operating and sites that reportedly were gasoline stations in the past.

Since a good understanding of the geology of the area was considered essential, three stratigraphic test holes (STH) were drilled in order to make this assessment. Locations for these were chosen in a roughly triangular pattern around the study area (Figure 1). Each encountered from 33 to 42 feet of loess and clay, underlain by 15 to 30 feet of terrace sands and gravels, which is in turn underlain by approximately 150 feet of Yazoo Clay. All test holes were advanced at least until the Moodys Branch Formation was encountered below the Yazoo Clay for use as a regional marker bed. This is illustrated in Figure 2, a cross section across the study area.

It was decided that twelve two-inch threaded PVC monitor wells would be installed at strategic locations in the community to allow for chemical and physical testing of the local terrace aquifer. The locations of the monitor wells, well fields, and test holes can be seen in Figure 1.

STH-1 was drilled 2500 feet south of the contaminated well field on property occupied by the local county barn and fire department. When the local (terrace) aquifer was encountered during drilling, a strong odor of gasoline was noticed by all present. Due to this, three of the monitor wells were installed in the immediate vicinity. Five of the monitor wells were installed in a circular fashion around the contaminated well field, and the remaining four were located near suspected sources of contamination. The only other

location where a gasoline odor was detected during drilling was Benton Monitor Well 9 (BMW-9), which is located near known underground storage tanks.

Following the completion of the initial stage of field work, the three stratigraphic test holes and twelve monitor wells, the Bureau of Pollution Control sampled the monitor wells and re-sampled the wells in the north well field. The result of these samples indicated that petroleum products were no longer present in the north field well, nor were they found in BMWs 1 through 5. Significant concentrations were found in BMW-9 (near a gasoline station) and BMWs 8, 11, and 12, which are in the immediate vicinity of the county barn and STH-1. The results of these tests were disappointing in the sense that they only confirmed what had been suspected during drilling, i.e., the only locations that tested positive for petroleum products were those where it was detected by the drilling crew during monitor well installation or test hole drilling. We did, however, conclude that not only were existing or abandoned underground storage tanks along Highway 16 a likely source of contamination but that there is apparently a source located at or near the county barn.

Operators of the county barn indicated that there were underground storage tanks on the property, but they were confident that none were leaking. Inspection by Bureau of Pollution Control officials confirmed that the underground tanks currently in use showed no evidence of leaking. The operators also reported that in the past the property has been used as a jail and for other activities so that they were unsure of exactly what might have been buried there, and that up to twenty feet of material has been removed during the past 15 to 20 years due to construction. We were also made aware of an abandoned well located on the property that had not been in use for approximately fifteen years. A tape was lowered into the well and it was found to be bridged at thirty-five feet.

Only two conclusions can be drawn based on the studies to date. They are: 1) Since the local water supply system has been out of operation for two years, the local direction of ground-water flow has returned to its natural state. The absence of pumping wells is allowing any contamination present to move in a direction other than toward the water supply wells. 2) There are apparently at least two potential sources of the contamination. They are along Highway 16 from operating and abandoned underground storage tanks and from an apparent source located on or near the property occupied by the county barn and fire department. The source of contamination here may be from underground storage tanks that have been abandoned, or it is possible that the abandoned well at this site could have been used to dispose of waste petroleum products in the past. In a further effort to determine the fate of any ground-water contamination, the Bureau of Geology has recently installed an additional six piezometers (BPW) in locations that should allow the local direction of ground-water flow to be determined when accurate elevations are acquired. In addition, a pumping test is also planned to determine aquifer characteristics. Also, because it is likely that the local direction and velocity of ground-water flow are affected by topography and limited topographic map coverage is available commercially at an appropriate scale, the Bureau of Geology has received assistance from the Mississippi State Highway Department by preparation of a topographic map of Benton. When all these data are collected and analyzed, predictions can be made as to the fate of the contaminants.

BUREAU DIRECTOR RETIRES

Alvin R. Bicker, Jr., State Geologist and Director of the Mississippi Bureau of Geology, retired from the Department of Natural Resources on June 30, 1986. Bicker had headed the Bureau of Geology since February 1980, after being named director that year. He was the 12th person to serve as State Geologist since the office was created in 1850.

Bicker, a native of Florida, grew up in Mississippi and graduated from high school in West, Mississippi.

He served in the 4th Infantry Division during World War II. After military service, Bicker attended Mississippi State University, graduating in 1950 with a Bachelor of Science degree in Petroleum Geology.

For the next 14 years, Bicker worked in Texas for several oil companies. He was district geologist with Texas Gulf Producing Company for almost ten years.

Bicker returned to Mississippi as economic geologist with the Mississippi Geological Survey in 1964. He served in progressively more responsible positions, including subsurface geologist, chief geologist, and senior administrative geologist, before being named acting director of the newly created Bureau of Geology in the Department of Natural Resources in 1980.

Bicker is well represented in the publications list of the Bureau. Among the more significant publications are:

Bulletin 107, Claiborne County Geology and Mineral Resources, 1966

Bulletin 110, Copiah County Geology and Mineral Resources, 1969

Geologic Map of Mississippi, 1969

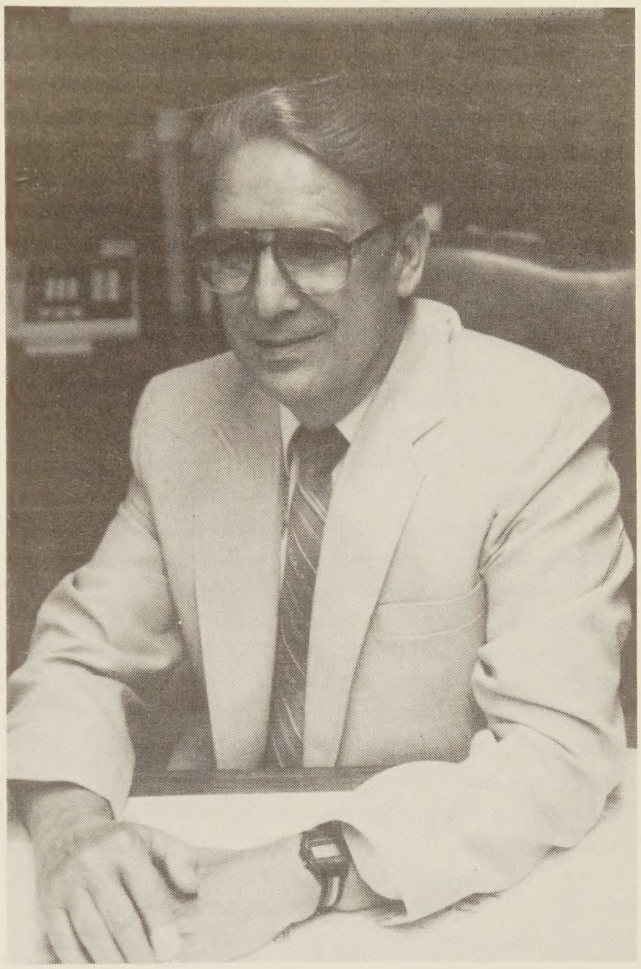
Bulletin 112, Economic Minerals of Mississippi, 1970

Information Series 72-1, Mineral Producers Directory, 1972

Information Series 72-4, Salt Water Disposal Wells in Mississippi, 1972

Cross Section 2, East-West Cross Section, Tishomingo County to Tunica County, Mississippi, 1974

Looking back on his 22 years of state service as a geologist, Bicker said technology has changed the way the geologist works. "Computers have helped in the construction of different types of maps, making them more accurate and quicker to produce. Logging techniques have changed dramatically with more sophisticated equipment," Bicker noted.



Bicker said that there are two unresolved projects he would like to have seen settled before retiring. "The storage of nuclear waste is still up in the air," he said, "as is the offshore drilling for oil and gas in the Mississippi Sound. I would have liked to have seen how these two issues came out before I retired."

Among his professional societies, Bicker holds membership in the American Association of Petroleum Geologists, the Mississippi Geological Society, and the Association of American State Geologists.

Bicker is married to the former Sarah Thomas of West; they are the parents of three sons and have five grandchildren.

THE BONY FISHES (TELEOSTS) OF THE TUSCAHOMA AND BASHI FORMATIONS, EARLY EOCENE, MERIDIAN, LAUDERDALE COUNTY, MISSISSIPPI

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Bony fish teeth and jaw sections that are commonly found in the Tuscahoma and Bashi formations of the early Eocene of the State of Mississippi are identified here for the professional and amateur fossil collector.

This article also introduces the discovery of fossil fish remains in a heretofore "nonfossiliferous" section of the Tuscahoma Formation, at Meridian, Mississippi—the only known fossil site in the state where marine fossils can be recovered from that formation, as well as from the well-known Bashi Formation at the same locality.

In 1979, the author and his assistant, Stan Hyne, of Ann Arbor, Michigan, were prospecting in the vicinity of Meridian, Lauderdale County, Mississippi. We were looking for the famous Bashi boulder zone at the Red Hot Truck Stop, off Interstate 20. At that locality, we did not get up to the top of the bluff for the boulder zone on that trip (the author spent some time at the boulder zone of the Bashi the following year), but we did discover a highly fossiliferous "fish-bed" zone while climbing up the glauconitic marls behind the Red Hot Truck Stop.

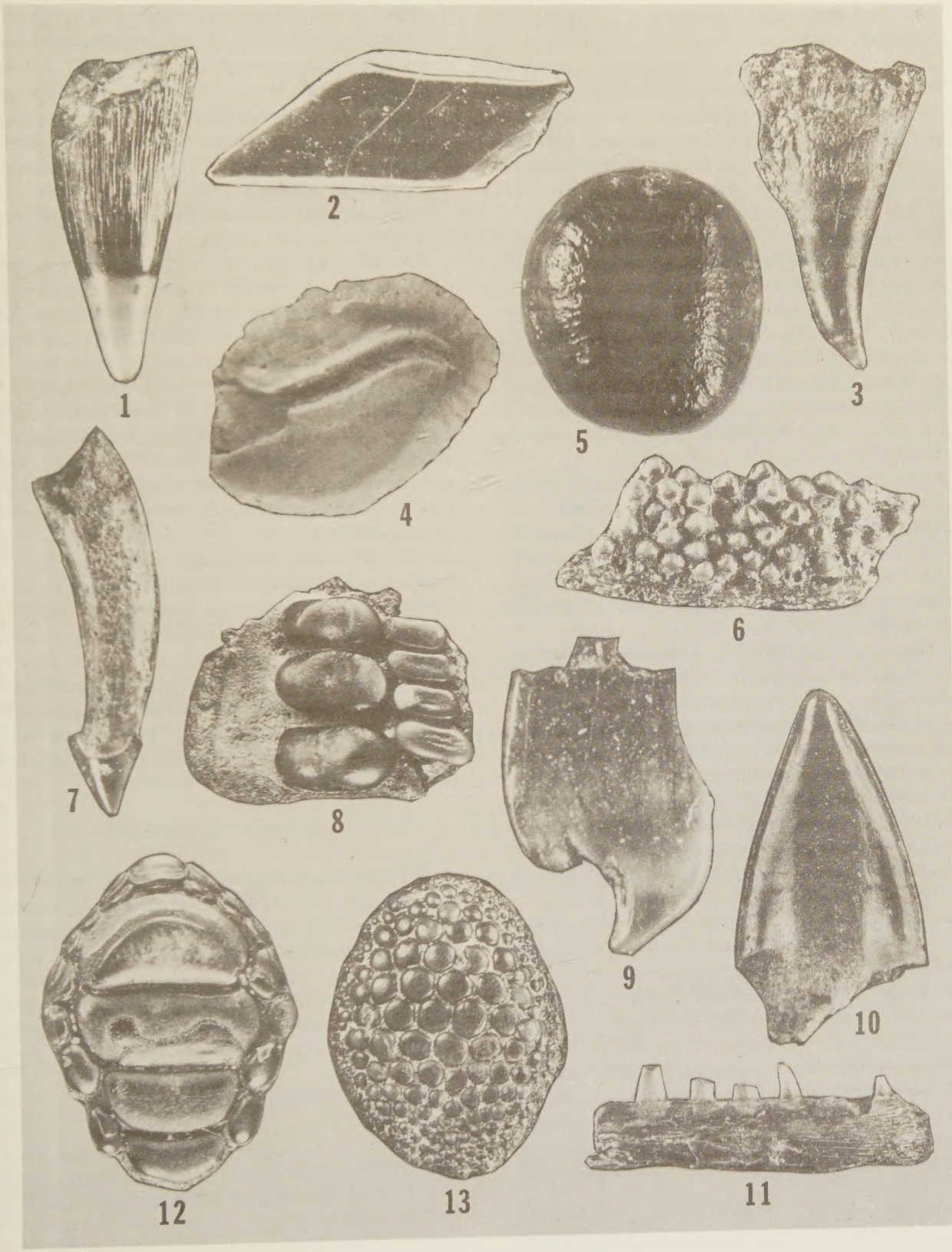
The Tuscahoma Formation at Meridian is probably of early Eocene age based upon the species of fish teeth found there.

The fossiliferous zone is situated approximately 10 feet up from the small creek bed (now named Crawdaddy Creek after the small crustaceans that inhabit that stream), and is overlain by several lignitic zones, one of which contains impressions of *Pinus,* the pine needle, as well as a beech leaf. The claystones are fragile and break up easily, and it is impossible to obtain complete leaf impressions.

The newly discovered fish-bed zone is called "Case's estuary number 1 site," and is listed as such in a recent paper by J. Alan Holman (1982). Holman described a 'pygmy python' from this site, now called officially *Palaeophis casei* Holman (named after the present author). Along with the presently described bony fish remains, and the pygmy python vertebral centra, the following teeth of sharks, skates, rays, and sawfishes have also been recovered (this material is presently under study and will subsequently be published):

Lamna aschersoni
Lamna lerichei
Eugomphodus hopei
Eugomphodus macrotus
Eugomphodus substriata
Odontaspis speyeri
Jaekelotodus trigonalis
Hypotodus robustus
Scyliorhinus gilberti
Abdounia subulidens
Abdounia beaugei
Hypoprion sp.
Galeorhinus affinis
Galeorhinus lefevrei
Galeorhinus minor
Galeorhinus ypresiensis
Galeus sp.
Physogaleus tertius
Ginglymostoma subafricanum
Nebrius thielensi
Jacquhermania duponti
Coupatezia woutersi

Figure 1, Tooth of *Lepisosteus suessionensis* Gervais, x12. Figure 2, Scale from *Lepisosteus suessionensis* Gervais, x8. Figure 3, Tooth of *Brychaetus muelleri* Woodward, with a partial jaw bone section, x 5. Figure 4, An otolith (fish earbone) of *Conger merides* Frizzel and Lamber, x11. Figure 5, A tooth cap of *Albula oweni* (Owen), x11. Figure 6, Section of the jaw with teeth of *Albula eppsi* White and Frost, x8. Figure 7, Tooth of *Trichiurides sagittidens* Winkler, x13. Figure 8, Jaw section of *Pycnodus bowerbanki* Egerton, x3.8. Figure 9, Tooth of *Eotrigonodon serratus* (Gervais), x28. Figure 10, Tooth of *Cybium proosti* Storms, x5.5. Figure 11, Dentary (jaw section) of *Cybium proosti* Storms, x6. Figure 12, Pharyngeal tooth plate of *Phyllodus toliapicus* Agassiz, x2.8. Figure 13, Pharyngeal tooth plate of *Egertonia isodonta* Cocchi, x2.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Dasyatis jaekeli
Pristis lathami
Burnhamia sp.
Myliobatis sp.

The find of the new fish bed was originally thought to be a part of the Bashi Formation. This author did not discover that it was not a part of the Bashi until just recently, so it is not the fault of J. Alan Holman that he reports the new species *Palaeophis casei* from the Bashi. It is, in fact, from the Tuscahoma Formation, which lies underneath the Bashi at this site. The "Case's estuary number 1 site" is in the Tuscahoma Formation!

The bony fish remains of the Tuscahoma Formation are similar in their species to those found in the overlying Bashi. However, the following types have not been recovered from the Bashi: *Cylindracanthus, Xiphias, Arius,* and *Brychaetus.* This does not mean that they do not exist in the Bashi Formation; it means only that this author has not collected them at this site from the Bashi, as yet.

The total fauna of the Tuscahoma and Bashi formations for the teleosts (bony fishes) is as follows:

Lepisosteus suessionensis (Figures 1 and 2), garpike fish tooth and ganoid scale from the fish's side. Specimen in Figure 1 measures 5 mm in overall length. Specimen in Figure 2 measures 8 mm across the longest width of the scale.

Brychaetus muelleri (Figure 3), an isolated dentary tooth, with partial root attached, from jawbone. Specimen measures 8 mm in its overall length.

Conger merides (Figure 4), an otolith (earbone) of a conger eel fish. These otoliths (and there may be as many as 5 different species represented) are found only in the Bashi Formation. The specimen illustrated measures 5 mm across the widest part of the earbone.

Albula oweni (Figure 5), an isolated tooth cap of this common drumfish. Specimen measures 4 mm in diameter.

Albula eppsi (Figure 6), a section of the dentary containing several 'croaker-type' fish teeth. Specimen measures 8 mm across the jaw section.

Trichiurides sagittidens (Figure 7), an isolated eel-like fish tooth. Specimen measures 5 mm in its overall length.

Pycnodus bowerbanki (Figure 8), a jaw section containing several 'crusher' or 'button' teeth of a pycnodont fish. This is only a fragment of a jaw; usually there are many more teeth situated on the bony base of the jaw. Specimen measures 13 mm across the jaw at its widest part.

Eotrigonodon serratus (Figure 9), one of the 'nibbling' teeth in the vomer region of the jaw of this damselfish. Specimen measures 2 mm in its overall height.

Cybium proosti (Figures 10 and 11), an isolated spade-like tooth (Figure 10, measures 8 mm in its greatest height), and dentary (Figure 11, measures exactly 1 cm across the jaw section containing 5 teeth). A carnivorous fish, similar in habits to the barracuda.

Phyllodus toliapicus (Figure 12), an essentially complete pharyngeal jaw section of a wrasse fish. Specimen measures approximately 21 mm in overall height.

Egertonia isodonta (Figure 13), another type of pharyngeal jaw of a wrasse fish. Jaw section measures 28 mm in its overall height.

The bill fragments of the sailfish *Cylindracanthus* were recovered from the Tuscahoma, as well as the fin spines of the marine 'catfish' *Arius* and the hypural (tail) bones of *Xiphias* (another billfish or sailfish), but they are not presently illustrated. They may be included in a future article.

Case's estuary number 1 site (Tuscahoma Formation) represents an estuarine environment associated with distributary channels of an ancient river delta. Material collected from this site consists of channel lag deposits in which denser and coarser objects such as teeth were concentrated. Very few, if any, littoral or benthic marine invertebrates have left traces in this estuary, but a number of smaller species of sharks and a variety of bony fishes (teleosts) that entered this ancient river left traces of their passing in the form of lost teeth. The vertebral centra (backbones) of snakes and fishes (sharks and bony varieties) indicate a mortality (death of the animal), while the isolated teeth may just indicate a loosened and subsequently "lost" tooth from the mouth of the living fish, which drifts down to the bottom of the river and is buried in the sands.

ACKNOWLEDGMENTS

The author would like to take this opportunity to thank the following persons who assisted him in the field during his 1979 and 1980 field trips to Lauderdale County, Mississippi: Messrs. Stanley Hyne, Ann Arbor, Michigan, and Paul Borodin, Malba, New York.

The excellent photography of the specimens on the plate was the work of Mr. Richard E. Grant of Dallas, Texas.

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TEROPODS (MOLLUSCA: GASTROPODA) FROM THE UPPER YAZOO FORMATION (EOCENE) AT CYNTHIA, MISSISSIPPI

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ABSTRACT

Two pteropod species are recognized from the upper zoo Formation (Shubuta Member equivalent) at the ss Lite Aggregate clay pit at Cynthia, Mississippi. ese species, *Bovicornu eocenense* Meyer, 1886, and *macina* sp., have previously been reported only from e Red Bluff Formation of the basal Vicksburg Group wer Oligocene). The extended range of these aracteristic species approximates the lower half of artini's calcareous nannoplankton zone NP 21.

INTRODUCTION

The upper Yazoo Formation at the Miss Lite Aggre- te clay pit in Cynthia, Mississippi, contains the best d thickest exposure of this unit in Mississippi. ockery and Siesser (1984) have correlated the Yazoo ction at this locality with the Shubuta Clay Member the Yazoo Formation in eastern Mississippi and estern Alabama and placed this interval in Martini's lcareous nannoplankton zone NP 21. They also listed e benthic molluscan and calcareous nannoplankton ecies found in the Yazoo Formation at Cynthia. mall mollusks have been largely overlooked at the ynthia clay pit and no pteropods were given in the evious report.

Recent field work at the Cynthia clay pit by geology udents of Louisiana Tech University included the llection of sediment samples at regular intervals rough the exposed section of Yazoo Clay. Foramini- era sieved from these samples have been studied to econstruct the paleoenvironment. The samples also ntained well preserved micromollusks, including a bstantial number of pteropods. Pteropods were icked from several samples and photographed on the ouisiana Tech University Department of Geosciences' canning electron microscope. Illustrations of these teropods are given in plates 1 and 2. Also illustrated on Plate 2 are small benthic gastropods not previously reported from the Yazoo Clay.

PALEOGENE PTEROPODS IN THE NORTHERN GULF

Collins (1934) listed twelve Paleogene pteropod species from the northern Gulf states of Texas, Mississippi, and Alabama, two of which were unnamed. Species cited from the Jackson and Vicksburg groups included: *Creseis simplex* (Meyer, 1886), *Creseis hastata* (Meyer, 1886), *Creseis corpulenta* (Meyer, 1887), *Bovicornu eocenense* Meyer, 1886, and *Bovicornu gracile* Meyer, 1887. Palmer and Brann (1965) later placed *Bovicornu eocenense* as a synonym of *Bovicornu gracile* without explanation. This placement is not followed here. Collins (1934) cited two species of *Limacina* from the Bashi Formation (lower Eocene) in Alabama but no species of this genus were recognized in the Jackson or Vicksburg groups.

Recent work by Hodgkinson has added a considerable number of species to the list of pteropods occurring in the Eocene of North America. Hodgkinson et al. (1985) in an abstract recognized 34 additional Eocene pteropod species, but did not give the species names or ranges. This work on pteropod biostratigraphy is ongoing, and is to be published at a later date. The present paper is concerned only with the pteropod fauna of the upper Jackson and lower Vicksburg groups.

As previously stated, three species of *Creseis* occur in the Jackson and Vicksburg groups. *Creseis simplex* and *Creseis hastata* have elongate, slender, conical shells. The latter species is characterized by an enlarged or bulbous tip. *Creseis simplex* of the Moodys Branch Formation (Jackson Group) is by far the larger of the two species (see MacNeil and Dockery, 1984, pl. 66, p. 383). *Creseis hastata*, an abundant species in the Vicksburg Group, has also been reported from the lower Oligocene (Stampian) at Gaas in the Aquitaine

Basin of southern France (Lozouet and Maestrati, 1982). Citations of this species in various Eocene units of Mississippi, Alabama, and Texas by Collins (1934) probably need to be reevaluated. *Creseis corpulenta* has a more rapidly expanding conical shell than the former two species. The type horizon for this species is the Moodys Branch Formation. MacNeil and Dockery (1984) compared a few specimens from the Glendon Limestone of the Vicksburg Group with *Creseis corpulenta,* but the Vicksburg specimens differed in lacking a bulbous tip.

Bovicornu gracile of the Moodys Branch Formation and *Bovicornu eocenense* (Plate 1, figures 1-6) of the upper Yazoo and Red Bluff formations have shells very similar to that of *Creseis hastata,* but with the added feature of being spirally twisted like a cow's horn, a feature alluded to by the generic name. Cossmann (1893) suggested that *Bovicornu* was probably a twisted specimen of *Creseis hastata.* Similarities between these taxa do suggest the possibility that the genus *Bovicornu* may only represent a deviation in the species *Creseis hastata.* MacNeil and Dockery (1984, pl. 66, p. 383) illustrated the various degrees of twisting exhibited in specimens of *Bovicornu eocenense* from the Red Bluff Formation. Whether *Bovicornu eocenense* is a twisted variation of *Creseis hastata* or not, it still is a readily recognizable form that is useful as a biostratigraphic indicator for the upper Jackson and lower Vicksburg groups. This distribution approximates the lower half of Martini's calcareous nannoplankton zone NP 21. *Bovicornu eocenense* may prove to be a useful biostratigraphic tool in the identification of this zone where the characteristic calcareous nannoplankton species are absent. *Bovicornu gracile* of the lower Jackson Group is known only from the holotype. This species is not likely to prove useful for biostratigraphic purposes or to be found in samples and mistaken for *Bovicornu eocenense.*

Associated with *Bovicornu eocenense* in the upper Jackson and lower Vicksburg groups is the sinistrally coiled (left-handed coil) pteropod *Limacina* Cuvier, 1817, also called *Spiratella* de Blainville, 1817. Name priority is a problem for this genus as two names were given it in the same year. Though both names are currently used, the former has perhaps the widest usage.

Two species of *Limacina* were cited by MacNeil and Dockery (1984) from the Red Bluff Formation. One species, which is known only from the illustrated specimen (MacNeil and Dockery, 1984, pl. 65, fig. 13), has a depressed spire and a nearly planispiral coil. It was compared with the Recent species *Limacina inflata* (d'Orbigny, 1847). The other species has a slightly elevated spire and a helical sinistral coil. It differs from *Limacina elongatoides* (Aldrich, 1887) and *Limacina choctavensis* (Aldrich, 1887) of the Bashi Formation (lower Eocene) in being less elongate and in having only a moderately elevated spire. It is similar in its general form to specimens of *Spiratella pygmaea* (Lamarck, 1804) illustrated by Curry (1965, p. 365, fig. 18-19) from the lower Eocene of Europe but differs in having less elevated and inflated whorls and in having a distinctively sloping spiral suture and shoulder. Small specimens of this unnamed species occur with *Bovicornu eocenense* in the upper Yazoo Formation at Cynthia, Mississippi (Plate 1, figures 7-8, Plate 2, figure 1).

BENTHIC INVERTEBRATE FAUNAS ASSOCIATED WITH *BOVICORNU EOCENENSE* AND *LIMACINA* SP.

The range of *Bovicornu eocenense* and *Limacina* sp. spans the Eocene-Oligocene boundary. Marine invertebrates occurring within this range consist largely of the Mollusca. The molluscan fauna of the upper Yazoo Formation at the Cynthia clay pit is given in Dockery and Siesser (1984). This fauna contains diagnostic Eocene taxa such as the gastropods *Pseudoliva, Athleta,* and *Mazzalina* and the bivalve *Venericardia* (*Venericor*). These taxa, along with most of the species present in the upper Yazoo Clay, do not occur in overlying Oligocene sediments.

Dockery (1984) recognized a major crisis event for molluscan faunas as coinciding with the Eocene-Oligocene boundary in the northern Gulf. This crisis event apparently had little effect on the calcareous nannoplankton flora, so it is not surprising that planktonic pteropod species continued across this boundary undisturbed even though most benthic gastropod species became extinct.

Four microgastropods previously unreported from the upper Yazoo Formation at Cynthia, Mississippi, are

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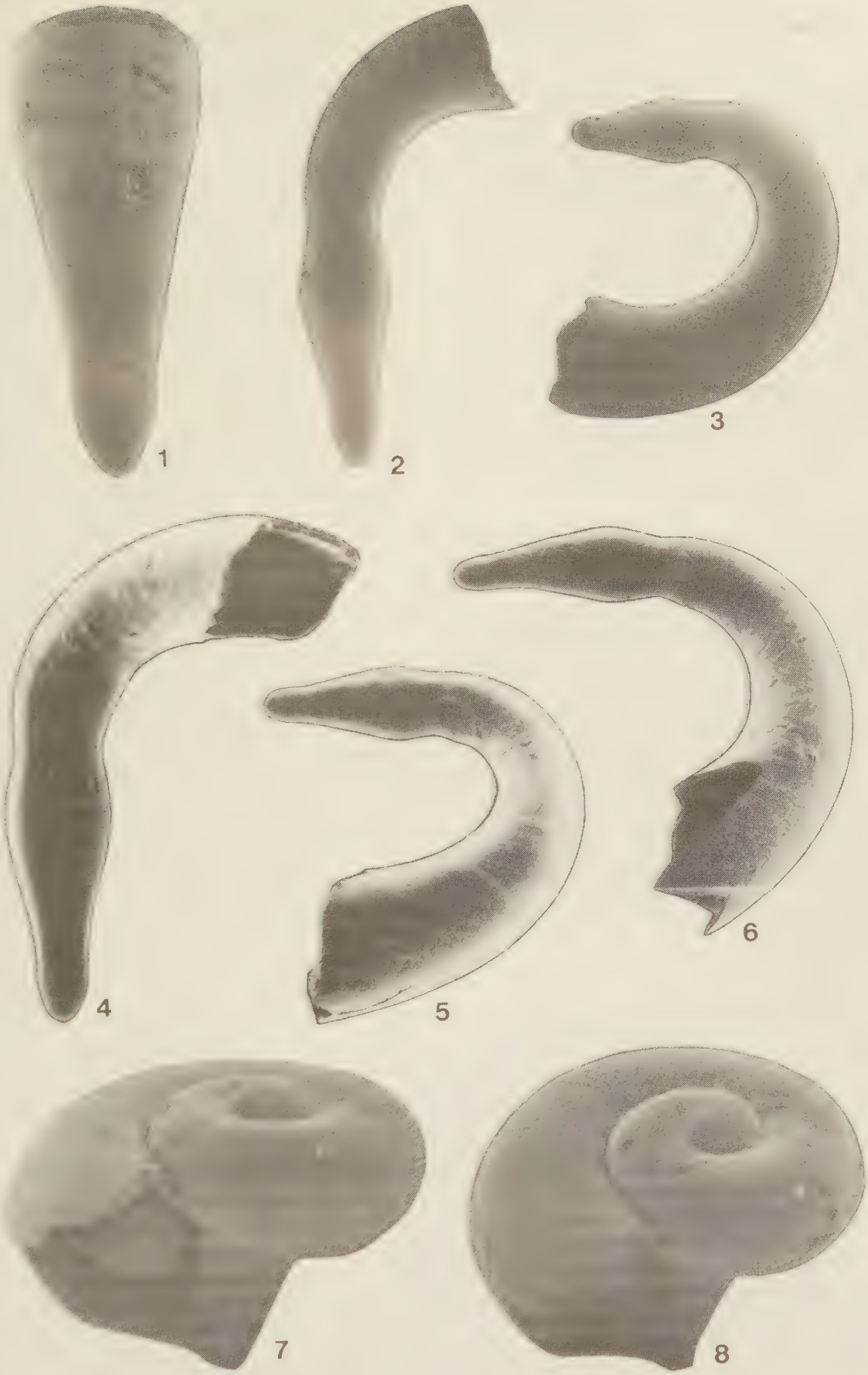
Plate 1. Figures 1-6, *Bovicornu eocenense* Meyer, 1886; 1 - juvenile x183, 2 - x97, 3 - x61, 4 - x100, 5 - x70, 6 - x70. Figures 7-8, *Limacina* sp.; oblique views of the same specimen x280.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illustrated in Plate 2. Three of these are juveniles and include an unidentified neogastropod species (Plate 2, figure 2), *Teinostoma* sp. (Plate 2, figures 4-5), and the larval shell of a cypraeid species (Plate 2, figure 6). The fourth species is the adult shell of an undescribed *Odostomia* (Plate 2, figure 3).

ACKNOWLEDGMENTS

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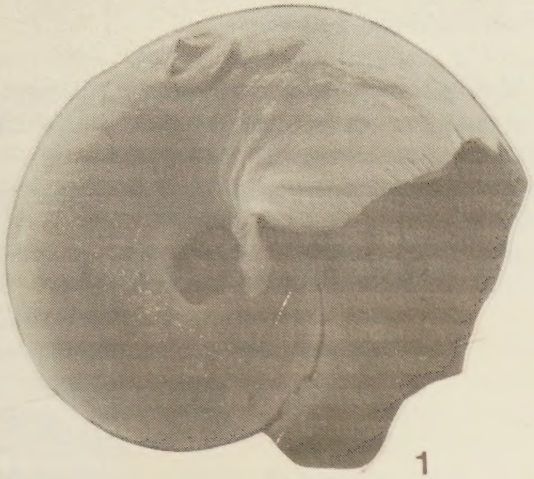
Plate 2. Figure 1, *Limacina* sp.; umbilical view x270. Figure 2, unidentified neogastropod juvenile x70. Figure 3, *Odostomia* sp.; apertural view x130. Figures 4-5, *Teinostoma* sp.; oblique views of the same juvenile specimen x100. Figure 6, Cypraeid larval shell x87.



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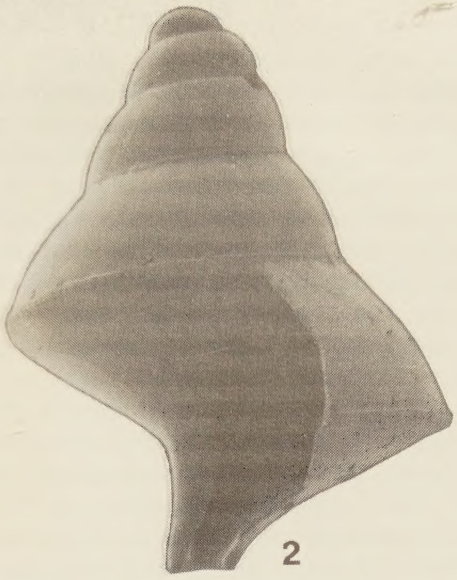

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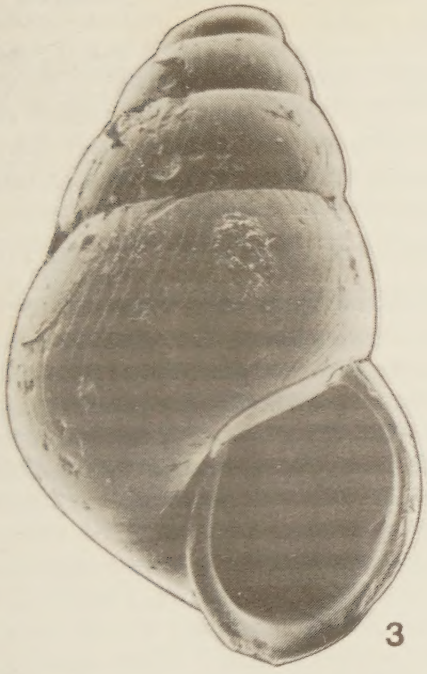

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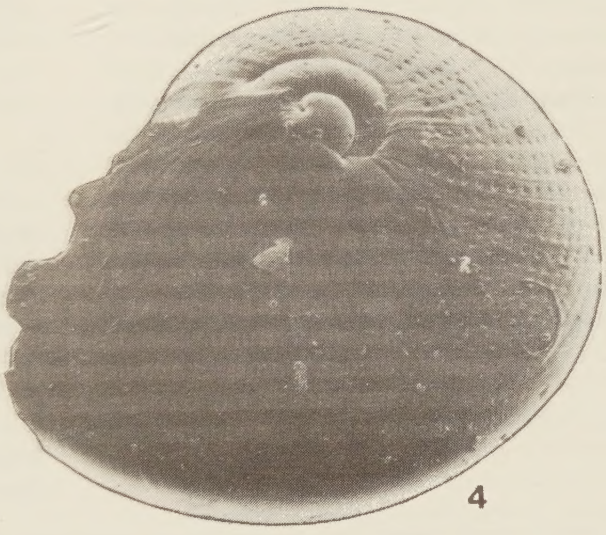

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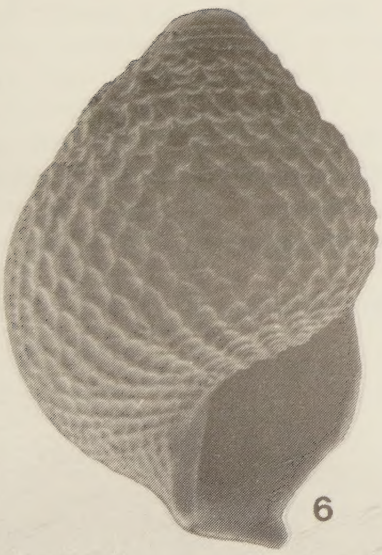

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BUREAU OF GEOLOGY PUBLICATION SALES

The Mississippi Bureau of Geology, as part of the state government, operates under a fiscal year running from July 1 through June 30. Following is a tabulation of the sales of publications during Fiscal Year 1986 (FY 86), which ended June 30, 1986. These are all publications of the Bureau of Geology (formerly the Mississippi Geological Survey), except for the topographic maps. The various topographic maps are made by the U. S. Geological Survey; the Bureau stocks for sale all available topographic maps of this state.

The Bureau's flagship publication series is the Bulletin. The agency has published 126 bulletins since commencing the series in 1907; 99 of the bulletins are still in print. In FY 86, 666 bulletins were sold. The largest seller (87 copies) was the bulletin most recently published, Bulletin 126, Newton County Geology and Mineral Resources. Other leading sellers were: Bulletin 105, Hinds County Geology and Mineral Resources, 29 copies sold; Bulletin 115, Rankin County Geology and Mineral Resources, 27 copies; Bulletin 88, Madison County Geology, 25 copies; Bulletin 40, The Upper Cretaceous Deposits (published in 1940), 21 copies; Bulletin 113, Water Resources of Mississippi, 19 copies; and Bulletin 124, Lower Oligocene Gastropoda, Scaphopoda, and Cephalopoda of the Vicksburg Group in Mississippi, 19 copies. The total of 666 bulletins sold in FY 86 is down from the total of 1053 sold in FY 85.

Another line of publications is the Information Series. During FY 86, the Bureau sold 201 copies of the 12 titles in this series. This was up from 154 copies in FY 85. Among other publications sold were:

- Geologic Map of Mississippi, scale 1:500,000, 116 copies
- small geologic map, 112 copies
- Economic Minerals Map of Mississippi, scale 1:500,000, 48 copies
- Cross Sections (5 titles), 62 copies
- Environmental Geology Series (3 titles), 36 copies
- Stratigraphic Column of Mississippi, 62 copies
- Compilation of Producing Formations in Mississippi (chart), 25 copies

Topographic maps published by the U.S. Geological Survey always sell briskly. During FY 86 the Bureau of Geology sold:

- Topographic maps, 7.5-minute and 15-minute quadrangles, 10,283
- Topographic maps, scale 1:250,000, 117
- State topographic map, scale 1:500,000, 119

For more information about Bureau of Geology publications and topographic maps of Mississippi, visit the Bureau office at 2525 North West Street, Jackson, telephone (601) 354-6228, or write to the Bureau of Geology, P.O. Box 5348, Jackson, MS 39216.

"To a person uninstructed in natural history, his country or seaside stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall."

Thomas Henry Huxley

CALENDAR OF EVENTS

eptember 17-19, 1986 - American Institute of Professional Geologists, meeting, Keystone, Colorado. (Lawrence Anna, Suite 1000, 1512 Larimer St., Denver, Colorado 80202. Phone: 303/571-1314)

eptember 25-29, 1986 - Society of Economic Paleontologists and Mineralogists, mid-year annual meeting, Raleigh, North Carolina. (SEPM, Box 4756, Tulsa, Oklahoma 74159. Phone: 918/743-2498)

eptember 29-October 2, 1986 - Remote sensing for exploration geology, meeting, Reno. (Remote Sensing Center, Environmental Research Institute, Box 8618, Ann Arbor, Michigan 48107. Phone: 313/994-1200)

ctober 5-8, 1986 - Association of Earth Science Editors, annual meeting, Duluth, Minnesota. (Jeane Moore, Ernest K. Lehmann and Associates, Suite 300, 1409 Willow St., Minneapolis, Minnesota 55403)

ctober 5-9, 1986 - Association of Engineering Geologists, annual meeting, San Francisco. (Alan Tryhorn, GeoResource Consultants, 851 Harrison St., San Francisco, California 94107. Phone: 415/777-3177)

ctober 12-15, 1986 - Clay Minerals Society, annual meeting, Jackson, Mississippi. (William R. Reynolds, Dept. of Geology and Geological Engineering, University of Mississippi, University, Mississippi 38677. Phone: 601/232-5818)

ctober 22-25, 1986 - Gulf Coast Association of Geological Societies and Gulf Coast Section, Society of Economic Paleontologists and Mineralogists, annual meeting, Baton Rouge, Louisiana. (Harry L. Roland, Jr., Louisiana Geological Survey, Box G, University Station, Baton Rouge, Louisiana 70893. Phone: 504/342-6754)

lovember 2-5, 1986 - Underwater Mining Institute, Biloxi, Mississippi. (Allen Miller, Underwater Mining Institute, University of Wisconsin Sea Grant, 1800 University Ave., Madison, Wisconsin 53705. Phone: 608/262-0645)

lovember 2-5, 1986 - Society of Exploration Geophysicists, annual meeting, Houston. (Marvin R. Hewitt, Amoco Production Co., Box 591, Tulsa, Oklahoma 74102. Phone: 918/660-3377)

November 10-13, 1986 - Geological Society of America, annual meeting, San Antonio, with associated societies: Cushman Foundation, Geochemical Society, Geoscience Information Society, Mineralogical Society of America, National Association of Geology Teachers, Paleontological Society, Society of Economic Geologists. (Jean Kinney, GSA headquarters, Box 9140, Boulder, Colorado 80301. Phone: 303/447-2020) Short courses: Computer graphics in geology; glacial and marine sedimentation; contaminant hydrogeology; seawater chronostratigraphy using strontium isotopes; microcomputers and geology; fossil radiolaria; rock mechanics.

November 21-22, 1986 - Depositional history of the Middle Ordovician in the Alabama Appalachians, field trip, Birmingham; by Alabama Geological Society. (D. Joe Benson, Dept. of Geology, University of Alabama, Box 1945, University, Alabama 35486. Phone: 205/348-1876)

December 7-10, 1986 - Gulf Coast Section, Society of Economic Paleontologists and Mineralogists, annual meeting, Corpus Christi, Texas. (Susan J. Conger Morris, 11422 Hornbrook Dr., Houston, Texas 77099. Phone: 713/495-6071)

May 12-14, 1987 - Coastal sediment processes, meeting, New Orleans. (Nicholas C. Kraus, Coastal Sediments '87, USAE Waterways Experiment Station, Coastal Engineering Research Center, Box 631, Vicksburg, Mississippi 39180)

June 7-10, 1987 - American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, annual meeting, Los Angeles. (AAPG headquarters, Box 979, Tulsa, Oklahoma 74101. Phone: 918/584-2555)

August 20-23, 1987 - Society of Economic Paleontologists and Mineralogists, fourth annual mid-year meeting, Austin, Texas. (Robert A. Morton, University of Texas at Austin, Bureau of Economic Geology, University Station, Box X, Austin, Texas 78712. Phone: 512/471-1534)

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